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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/805,890	03/22/2004	Padmapani C. Nallan	7017 C1/ETCH/METAL-NVM/JB	1896
44182	7590	12/29/2006	EXAMINER	
PATTERSON & SHERIDAN, LLP			TRAN, BINH X	
APPLIED MATERIALS INC				
595 SHREWSBURY AVE			ART UNIT	
SUITE 100			PAPER NUMBER	
SHREWSBURY, NJ 07702			1765	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		12/29/2006	PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

## Office Action Summary

**Application No.**

10/805,890

**Applicant(s)**

NALLAN ET AL.

**Examiner**

Binh X. Tran

**Art Unit**

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 11-14-2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-18, 21 and 22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-18, 21-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. This office action is responsive to the amendment after final filed on 11-14-2006. Upon further consideration, the examiner decides to withdraw the previous allowable subject matter. This following office action is a non-final rejection.

#### ***Terminal Disclaimer***

2. The terminal disclaimer filed on 11-14-2006 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of 7,094,704 has been reviewed and is accepted. The terminal disclaimer has been recorded.

#### ***Specification***

3. The disclosure is objected to because of the following informalities: In the "Cross Reference to Related Application" section of the specification, after the phrase "US Patent application Serial No. 10/092,795 filed March 6, 2002" the examiner suggests applicants insert --now US Patent 6,806,095-- to reflect the current status of that application.

Appropriate correction is required.

#### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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5. Claims 7 and 11 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 7 and 11 are indefinite because they directly depend on cancelled claim 5. For the purpose on examination, the examiner will assume the claim 7 and 11 depend on claim 1.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1-4, 6-8, 12-18, 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moise et al. (US 2001/0055852) in view of Jeon (US 6,790,755) and Xing (Us 6,492,222).

Respect to claim 1, 12, 17, and 21, Moise discloses a method for etching comprising the step of:

introducing into an etch chamber a substrate having a dielectric material (such as PZT);

providing into the etch chamber a process gas comprising CO and Cl<sub>2</sub> (paragraph 0159, 0160, 0166);

expose the dielectric material to a plasma formed from the process gas.

Moise further discloses it is possible to replace PZT with Hf containing material as an alternate material (paragraph 0148). Moise fails to disclose the dielectric material is TaO<sub>2</sub> (aka tantalum oxide) or ZrO<sub>2</sub> (aka zirconium oxide) or ZrSiO<sub>2</sub> (aka zirconium silicate), or HfSiO<sub>2</sub> (aka hafnium silicate). However, Moise clearly teaches to use high-k dielectric material including PZT. In a method for making semiconductor device, Jeon teaches to use PZT, tantalum oxide, zirconium oxide, zirconium silicate or hafnium silicate as a high-k dielectric material. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Moise in view of Jeon by using tantalum oxide, zirconium oxide, zirconium silicate or hafnium silicate because equivalent and substitution of one for the other would produce an expected result.

Claims 1, 12, 17 and 21 differ from Moise and Jeon by the specific flow rate of CO gas and halogen containing gas. However, Moise clearly teaches to use CO and Cl<sub>2</sub> (i.e. halogen) gas. In a method for etching ferroelectric material (aka high dielectric constant material), Xing teaches the flow rate of chlorine containing gas and oxygen containing gas is a result effective variable (Table 5). Xing further discloses oxygen-

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containing gas is selected from either O<sub>2</sub> or CO (col. 28 lines 50-54). Xing further disclose the flow rate of Cl<sub>2</sub> is about 50 sccm and oxygen gas is 20 sccm (Table 2, read on applicants' range). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment as suggested by Xing in order to obtain optimal flow rate as an expected result.

Respect to claims 2-4, and 22 Moise discloses to use Cl<sub>2</sub> gas (paragraph 0159, 0160, 0166). Respect to claim 6, Moise discloses the step of maintaining a gas pressure of 10 mtorr (paragraph 0097, read on applicant's range of 2-100 mtorr). Respect to claim 8, Moise discloses applying a bias power to a cathode electrode of 0-1000 Watts (Fig 1a, read on applicant's range).

Claim 7 differs from Moise and Jeon by the specific pressure value. In a plasma etching method for high-k dielectric material, Xing discloses that the plasma process pressure is a result effective variables (Table 2-6). Xing further discloses teaches to adjust the pressure value in order to control etch rate (Table 5). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal pressure to obtain an expected result.

Respect to claims 13-14, Moise discloses the step of maintaining a temperature of 250-400 °C during etching (paragraph 0205, read on applicant's claimed range). The limitation of claims 15, 18 and 22 has been discussed above under Moise's reference. Respect to claim 16, Moise teaches to use HCl as a chlorine source (table in paragraph 0160). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Moise by etching Hafnium containing material with CO and chlorine because equivalent and substitution of one for the other would produce an expected result.

9. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Moise in view of Jeon and Xing as applied to claim 1-6 above, and further in view of Fujikawa et al. (US 6,764,972).

Claim 9 differs from Moise, Jeon and Xing by the specific bias power value. However, Moise clearly teaches to control the bias power between 0-1000 Watts (Fig 1a). In a plasma etching method, Fujikawa discloses that the bias power value is a result effective variables vary from 10-25 Watts (col. 7-8, within applicants value). The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment as suggest by Fujikawa in order to obtain optimal bias power as an expected result.

10. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moise in view of Jeon and Xing as applied to claim 1-6 above, and further in view of Hart et al. (US 2002/0142609).

Claims 10-11 differ from Moise, Jeon and Xing by the specific inductive source power. However, Moise clearly teaches to use inductive couple plasma (ICP, See paragraph 122). In a plasma etching method, Hart discloses inductive source power is a result effective variable. Hart further discloses to control the source power of 800 watts to 3.5 kilowatts (paragraph 0045, within applicant's range). The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment as suggest by Hart in order to obtain optimal source power as an expected result.

### ***Conclusion***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should



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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*Binh Tran*

Binh X. Tran